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# The Influence of the Irregular Movements in the Lower Thermosphere on the Ionospheric Es-Layer by Radiometeor Observations in Kazan (56°N, 49°E)

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**Abstract.** Significant influence of diurnal and inter-diurnal variations of irregular movements at heights of the lower thermosphere on the frequency parameters of ionospheric sporadic E-layer, characterizing its intensity, was found out. Common periodicities with time scales of planetary waves, having significant coherence, were revealed in variations of mesoscale turbulence intensity and critical frequency foEs, blanketing frequency fbEs.


## 1. Introduction

The regular ionosphere is quit well studied and described in different models to the present time. However, ionosphere layers with increased electron concentration – sporadic E-layers, forming in the E – region as a thin layer (several kilometers) at heights near 100-110 kms – don't have a final physical model of their origin. It is known that dynamical processes at the heights of the lower thermosphere have a significant influence on the sporadic E-layer formation. According to the theory of wind shear (Whitehead, 1961; Gershman et al., 1976), height gradients of a zonal wind are necessary for formation of increased electron concentration regions at heights of the lower ionosphere. Also, internal gravity waves (IGW) have an influence on the E-layer formation (Sidorov et al., 1987). The presence of IGW in the lower thermosphere form the sinusoidal profile of a zonal wind, i.e. create a condition for forming of the electron concentration irregularities.

Many scientists, for example, (Ginzburg et al., 1987; Chimonas, 1974; Bencze, 1983) consider that conditions of E-layer formation and destruction are connected with the presence of developed turbulence in heights 100-110 kms – at heights of turbopause. Presence of intensive non-blanketing E-layer is connected with decrease of turbulence and presence of strongly semi-transparent E-layer – with its increase.

The values of the maximum scales of turbulent whirls, obtained by wind radiometeor measurements (Teptin and Fahrutdinova, 1972), agree well with values of the horizontal scales of Es-formations, observed by ionosphere measurements in Ashabad (Karadgaev, 1983).

In this work we tried to evaluate effects of the intensity of irregular movements at heights of the lower thermosphere on the Es-layer behavior.

## 2. Technique and Measurements

The radiometeor observations were conducted during 1986-1989 by the meteor radar with altimeter of the Kazan State University for the height region 80-110 km. The main specifications of radar are: working frequency - 32 MHz; pulse duration – 100 mks, sounding frequency – 400 Hz, pulse power of the transmitter is ~100 kW. Resolution on the height - ± 1 km. Area of sounding 400 x 400 km. A site of complex – $56^0$N, $49^0$E.

Irregular movements in the lower thermosphere, from our point of view, are a superposition of short-period IGW and small-scale turbulence. As parameter, commonly describing irregular movements, we used the parameter, calculated according to the formula:

$$B = \frac{\sum_{i=1}^{N} p_i (V_{hi} - \overline{V_{hi}})^2}{\sum_{i=1}^{N} p_i^2}, \quad [m^2/s^2]$$

where $p_i$ - statistical weight of the i-th velocity measurement (on i -th meteor), $V_{hi}$ - horizontal velocity of the wind. Further we named it "the intensity of mesoscale turbulence". Physically B characterizes the energy of irregular movements per unit mass. All irregular movements with spatial and temporary scales

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